EXD.

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NEW DATA CONCERNING *THAUMATOXENA* BREDDIN & BÖRNER (DIPTERA PHORIDAE)

By F. W. Edwards, F.R.S., F.R.E.S., and H. Schmitz, S.J.

In September 1938 Mr. Eric Burtt sent to Prof. G. D. H. Carpenter at the Hope Department, Oxford University, a minute cockroach-like insect. Accompanying the specimen was the following note regarding the circumstances of its capture :

" During March 1937 I was staying at the rest house at Old Shinyanga, Tanganyika Territory. As is usually the case during this period of the long rains, minute Diptera belonging to the Phoridae were being a minor source of annoyance to everyone, owing to their habit of flying near the face, particularly the orifices of the ears, so that they are heard to emit a high-pitched, irritating note.

" On March —, whilst sitting at lunch, I again imagined I was being pestered by a Phorid about the ears and gave a sharp flicking motion with my hand to remove the annoyance. I found I had knocked a couple of minute insects which were *in cop.* on to the table-cloth. At first glance I took them to be midges. They moved rapidly, the stouter-bodied ♀ being dragged by the minute very active male. I attempted to arrest their careering motion by dabbing at them with my finger. I killed the ♀, but the male escaped and I saw it immediately fly away."—E. Burtt.

Prof. Carpenter and Dr. B. M. Hobby at once recognised that the specimen was of unusual interest, and brought it to the British Museum for determination. Reference to the literature of the Phoridae soon showed that the specimen belonged to the little-known genus *Thaumatoxena*, and in order to make sure of its specific identity I forwarded it to Father H. Schmitz. As a result of his examination of the specimen and re-study of the literature, Father Schmitz concluded that Mr. Burtt's capture belongs to a new species, and further made the surprising discovery that the supposed males previously attributed to *T. wasmanni* must be females of two different (and hitherto unnamed) species. It had been supposed that the male *Thaumatoxena* is wingless like the female, but Mr. Burtt's discovery has revealed for the first time that this is not the case; the male, as with other more or less related genera of Phoridae, is a normal winged fly.

The genus *Thaumatoxena*, sole representative of its subfamily, is confined to Africa, and the few specimens recorded hitherto have all been found in the nests of termites. The female is remarkably unlike an ordinary Dipterous insect, having the body rounded and almost bare, the small antennae sunk into deep pits, the eyes rudimentary, the dorsal plates of the body reduced to one thoracic and two abdominal, the wings reduced to small rigid projections each with a strong apical bristle, and the legs so constructed that they can be folded away underneath the body, the tibiae fitting into deep grooves in the femora. All these peculiarities can be regarded as adaptations to life in nests of termites. The general appearance of the insect can be judged from the accompanying figures. Fig. 1 shows in side view *T. wasmanni* Breddin & Börner (from a figure by Börner in 1908, *Zool. Anz.* **32** : 538); fig. 3 shows in

front view Mr. Burtt's specimen. In the related subfamily AENIGMATIINAE, represented in Britain by the myrmecophile *Aenigmatias blattoides* Meinert (= *Platyphora lubbocki* Verrall), the females are also wingless, but their modifications are less extreme, the eyes being less reduced, antennae not sunk into pits, and abdomen with several separate tergites (see fig. 2).[1]

Mr. Burtt's remark on the pestering habits of Phorids at Shinyanga is interesting, as it would appear to be the first time that any such complaint has been made against an insect of this family.[2] The habit being so unusual it may be surmised that the flies which act in this way belong to a particular species, and it seems not improbable that they are the males of *Thaumatoxena*.

F. W. E.

Der Fund von Mr. Eric Burtt ist aus zwei Gründen sehr interessant, nämlich weil die *Thaumatoxena*-Art neu ist, und weil wir erfahren, dass das ♂ geflügelt ist, während bisher angenommen wurde, dass bei *Thaumatoxena* beide Geschlechter stark verkümmerte Flügel hätten.

I.

Thaumatoxena burtti sp. n.

Die neue Art, die nur in einem etwas beschädigten ♀ Exemplar vorliegt, ist ebenso gross wie *T. wasmanni* Bredd. et Börner, wie Fig. 4, a und b zeigen. Beide Arten erreichen 2·0 mm. Länge. Die Organisation ist in allen wichtigeren Punkten die gleiche, im folgenden werden daher nur die spezifischen Unterschiede hervorgehoben. Zum Vergleich dienen die beiden in Coll. Wasmann vorhandenen, sehr gut erhaltenen ♀♀, nach denen *wasmanni* beschrieben worden ist. Andere Exemplare von *wasmanni* sind nicht bekannt.

Die neue Art ist ein wenig dunkler, Kopf und Thorax sind schwarz braun, bei *wasmanni* mehr dunkel rotbraun. Das dritte Fühlerglied ist bei beiden Arten gelblich weiss.

Grösse, Form und Wölbung des Kopfes sind bei der neuen Art wie bei *wasmanni*. Dass in fig. 4, a die seitlichen Hinterecken des Kopfes weniger weit nach aussen und hinten reichen als in fig. 4, b (*wasmanni*), bedeutet keinen wirklichen Unterschied : bei seitlicher Betrachtung erkennt man, dass auch bei der neuen Art die hinteren Aussenecken des Kopfes ganz nahe an die Stelle heranreichen, die man erhält, wenn man die Grenze zwischen dem ersten und zweiten Abdominalsegment beiderseits nach aussen bis zur Berührung mit dem äusseren Körperumriss verlängert. Ein wirklicher Unterschied herrscht aber in der Beborstung des Kopfes. Man hat bisher in den *Thaumatoxena*-Beschreibungen die genaue Zahl und Stellung der Kopfborsten nicht studiert; doch bietet die Chätotaxie des Kopfes, wie bei Phoriden überhaupt, so auch bei *Thaumatoxena* nicht zu vernachlässigende Artmerkmale, obwohl ihre " Stirnborsten " nur feine (aber ziemlich lange) Haare sind. Auch die Fusspunkte der Haare sind abgeschwächt, aber immerhin als feine eingestochene Punkte erkennbar. Ganz verloren gegangen ist die sogenannte " Grundbehaarung " der Kopfoberseite, was sonst bei keiner Phoride der Fall ist.

T. wasmanni hat zwölf ganz symmetrisch angeordnete *Kopfborsten*, davon sind die sechs der linken Kopfhälfte in fig. 5 dargestellt. Der Vorderrand (= Unterrand) des Kopfes ist bei *wasmanni* unbeborstet. Quer über die Mitte des Kopfes läuft eine Reihe von acht " Borsten," in fig. 5 mit 1, 2, 3, 4 bezeichnet. 1 steht nahe den Hinterecken, 2 und 3 etwas vor den Fühlergruben und zwar zu beiden Seiten davon, 4 ist der Stirnmediane genähert. Hinter 4 steht etwas weiter auswärts Borste 5, und hinter dieser, ganz am Scheitelrande,

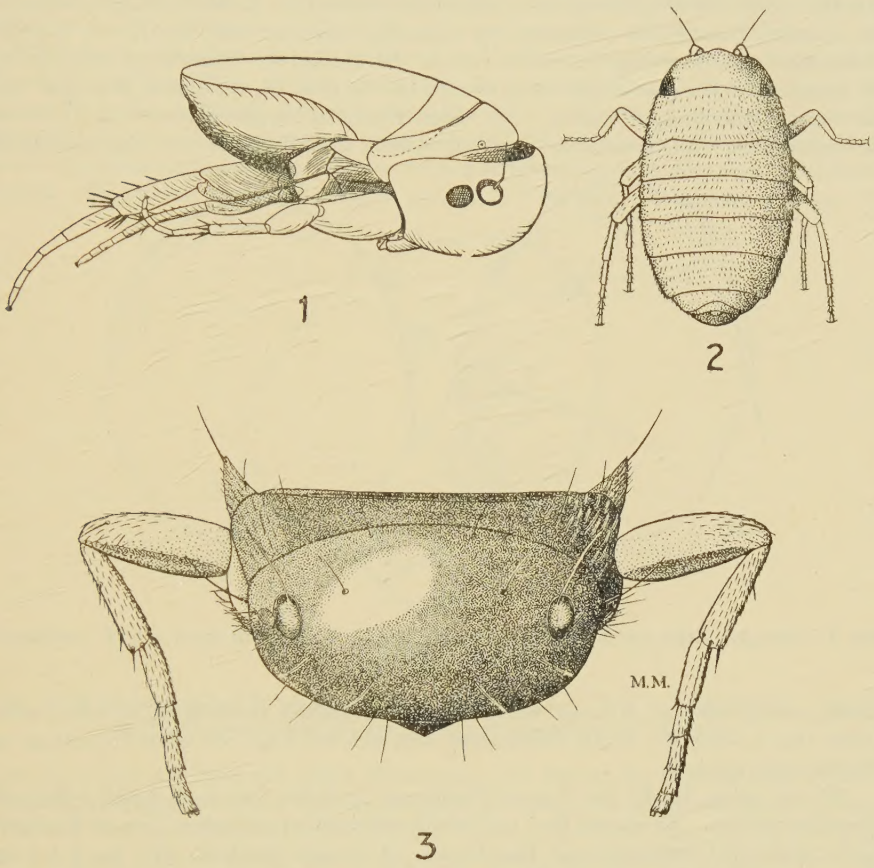
[1] Dr. O. W. Richards suggests that the wing-rudiments of *Thaumatoxena* represents only the basicosta, the rest of the wing having atrophied.

[2] Since Mr. Burtt made his observations two complaints have been received at the British Museum of pestering by *Megaselia bovista* Gimm, in coal-mines in Yorkshire.

Borste 6. Das Borstenpaar 5, 5 steht etwas weiter auseinader als das Paar 4, 4 und 6, 6. Die ganze Beborstung kann also in folgender Formel dargestellt werden :

6 6
5 5
1 2 3 4 4 3 2 1

Genau dieselben " Borsten " und in derselben Verteilung hat auch die neue Art (Länge der " Borsten " 0·18 mm.), aber es kommen bei ihr noch jederseits vier bis sechs andere hinzu, die in fig. 5 mit punktierten Linien angegeben sind : nämlich je zwei bis drei am



Figs. 1–3.—(1) *Thaumatoxena wasmanni* Breddin & Börner. ♀ (Nach Börner) ; (2) *Aenigmatias blattoides* Meinert. ♀. (Nach Meinert) ; (3) *Thaumatoxena burtti* sp. n. ♀. Vorder Ansicht.

Hinterrand seitwärts, also ganz in der Nähe von Borste 1, und ein Paar am Vorderrande nicht weit von einander, etwa so, dass das linksseitige Paar vom rechtsseitigen ebenso weit wie die beiden Augen von einander entfernt ist.

Die *Fühlergruben* sind der beiden neuen Art etwas grösser als bei *wasmanni*, die Augen dagegen kleiner und noch mehr als bei *wasmanni* verkümmert, vgl. fig. 6, a und b. Form der Fühlergruben bei der neuen Art (fig. 6, b) breit elliptisch, 0·180 × 0·216 mm. Bei *wasmanni* ist die Fühlergrube auch bisweilen elliptisch z.B. 0·160 × 0·190 mm., meist aber einem etwas verzerrten Kreise ähnlich (fig. 6, a) und durchschnittlich 0·170 mm. im

Durchmesser. Die *Fühler* bei der Arten zeigen keinen unmittelbar auffallenden Unterschied; Einzelheiten konnten wegen der versteckten Lage dieser Organe und wegen Beschädigung der Arista bei der neuen Art nicht untersucht werden.

Ein sehr deutlicher Unterschied ist bei den *Augen* in Form, Grösse und Anzahl der Ommatidien zu bemerken. Bei *wasmanni* ist das kreisrunde Auge etwas weiter vom Rande der Fühlergrube entfernt (fig. 6, a), der Durchmesser ist etwas variabel, 0·140 mm. oder weniger; auch bei demselben Tiere können die beiden Augen ungleich gross sein, aber immer gilt, dass bei *wasmanni* das Auge fast so gross ist wie die benachbarte Fühlergrube (fig. 6, a). Es ist ferner bei dieser Art scharf umrandet und äusserst schwach im ganzen gewölbt—diese Wölbung beträgt nur wenige Mikromillimeter. Es ist regelmässig fazettiert, die einzelnen Ommatidien erscheinen wie rotbraune, einander nicht berührende Kreislein in den Maschen eines feinen schwarzen Netzes. Die Anzahl der Ommatidien schwankt um 60 herum. Bei der einen Type zählt man rechts 69, links 56, bei diesem Exemplar sind die Augen deutlich ungleich gross. Das andere Exemplar hat gleichgrosse Augen mit etwa 62 Ommatidien. Alle genannten Umstände wirken zusammen, um das Auge verhältnis-

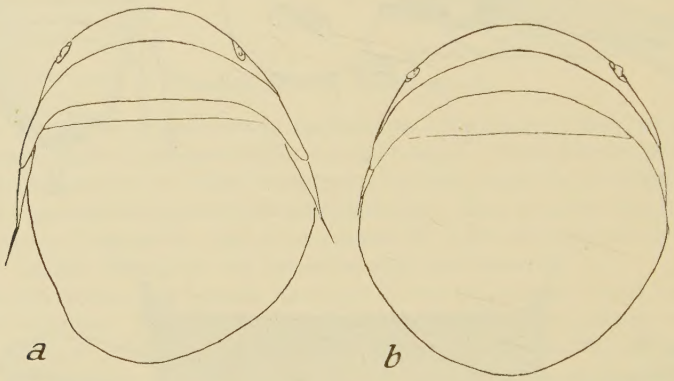


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Fig. 4.—Körperumriss von *Thaumatoxena* spp. ♀♀. a, *T. burtti* sp. n.; b, *T. wasmanni* Breddin & Börner.

mässig gut hervortreten zu lassen, wenigstens bei binokularer Betrachtung in auffallendem Licht, aber so stark wie in den Zeichnungen hebt sich das Auge von seiner Umgebung am Objekt selbst nicht ab.

Bei der neuen Art ist das Auge viel schwerer zu finden und kann leicht vollständig übersehen werden. Es ist ganz flach und erhebt sich nicht im geringsten über die Kopfoberfläche, auch die Umrandung und Fazettierung ist weniger deutlich. Wie fig. 6, b zeigt, ist es merklich kleiner als die Fühlergrube, und von elliptischem Umriss, der grösste Durchmesser beträgt etwa 0·115 mm. oder wenig mehr, das Verhältnis der langen Achsen von Fühlergrube und Auge ist zwischen 7 : 4 und 3 : 2 (bei *wasmanni* 17 : 14). Das Auge ist dem Fühlergruben-Rande stärker genähert, es hat wie bei *wasmanni* regelmässige Reihen von Ommatidien (fig. 6, b), die sich nur bei sehr günstiger und intensiver Beleuchtung zählen lassen, es sind im ganzen ± 35. In fig. 6, b sind nur die Schnittpunkte des feinen Netzes, in dessen Maschen die Ommatidien liegen, dargestellt. Alles zusammenfassend kann man sagen, dass das Auge der neuen Art in jeder Beziehung stärker reduziert ist als bei *wasmanni*. Bei *T. andreinii* Silv. und den übrigen bisher beschriebenen, aber noch unbenannten Arten (sie wurden alle irrtümlicher Weise mit *wasmanni* oder *andreinii* identifiziert) ist die Anzahl der Ommatidien noch weit geringer, höchstens 16.

Der *Thorax* ist bei der neuen Art dorsal längs der Mediane gemessen etwas länger als bei *wasmanni* (0·32 bzw. 0·21 mm), aber diese Masse sind nicht absolut zuverlässig, weil sie sich nur auf den von oben her sichtbaren Teil des Thorax beziehen, dessen Vorderrand bei verschiedenen Exemplaren verschieden weit vom Kopfhinterrande bedeckt zu sein pflegt. Sicher ist aber, dass der Thorax der neuen Art dorsal merklich länger ist als bei *wasmanni*, während umgekehrt bei dieser die Länge des ersten Abdominalsegments bedeutend grösser ist als bei der neuen Art, entsprechend fig. 4, a und b (in a = 0·133 mm., in b = 0·247 mm.).

Wie die Beborstung des Kopfes, so ist auch die *Chaetotaxie des Thorax* von den bisherigen *Thaumatoxena*-Beschreibern nicht genügend studiert worden, aber für die Systematik von Bedeutung. Bei *wasmanni* gilt folgendes: Zu unterscheiden sind *abgeschwächte Borsten* und *Feinhaare*. Letztere sind etwas kürzer und haben weniger markierte Fusspunkte, aber beide sind haardünn. Auf dem mittleren Thoraxdrittel fehlt die Feinbehaarung, sie ist auf die beiden seitlichen Drittel beschränkt. Von " Borsten " gibt es eine Querreihe in einem gewissen Abstand vom Vorderrande und eine längs des Hinterrandes. Von beiden Querreihen gilt, dass ihre Elemente seitlich näher bei einander stehen als im mittleren Drittel. Die vordere Querreihe zählt im ganzen 16 " Borsten," die hintere nur etwa 10.

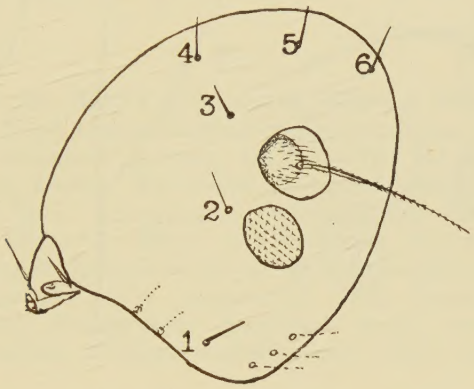

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Fig. 5.—Kopf von links, *T. wasmanni* Breddin & Börner. 1–6. Kopfborsten. Punktiert: die ausserdem bei der neuen Art vorhandenen " Borsten."

Von der neuen Art lässt sich leider Beborstung und Behaarung nicht mit der gleichen Genauigkeit angeben, weil der Thorax, wie auch der Rücken des Abdomens durch das beim Töten des Tieres austretende Blut verschmiert wurde. Es scheint aber, dass bei der neuen Art das ganze mittlere Drittel des Thorax von *Borsten* gemieden wird, während die *Feinhaare* sogar die ganze mittlere Hälfte meiden und auf das äusserste Viertel jederseits beschränkt sind. Borsten und Feinhaare sind also an Zahl geringer als bei *wasmanni*, an Länge und Stärke jedoch wie dort.

Auch die *Flügelrudimente* beider Arten sind in Grösse und Form deutlich verschieden, wie fig. 6, c und d zeigen. Sie sind bei beiden Arten annähernd rechtwinklig dreieckig, die längere " Kathete " ist der Vorderrand (= Aussenrand). Dieser hat bei der neuen Art die Länge von 0·47 mm., bei *wasmanni* nur 0·36 mm. Da die Flügelbreite an der Basis bei beiden Arten wenig verschieden ist, so ist der Flügel der neuen Art bei grösserer absoluter Länge relativ schmaler als bei *wasmanni*. Auch auf den Flügeln von *Thaumatoxena* gibt es " Borsten " und Haare. Die Haare meiden einen mehr oder weniger breiten Saum längs des Hinterrandes. Borsten gibt es bei *wasmanni* vier, vgl. fig. 6, d; die längste

(Länge bei der neuen Art 0·32 mm., Breite an der Basis weniger als 0·01 mm.) steht nahe der Flügelspitze, zwei andere nahe der Basis, eine in der Mitte des Vorderrandes. Bei der neuen Art ist die Behaarung und wahrscheinlich auch die Beborstung dieselbe, doch konnte die an der Basis des Vorderrandes stehende Borste nicht ermittelt werden, aus dem beim Thorax angegebenen Grunde.

Der kurze erste Abdominaltergit ist bei beiden Arten vollständig nackt.

Der grosse zweite Tergit, eine schildförmige Verschmelzung der bei normalen Phoriden vorhandenen Tergite 2–6, hat bei beiden Arten dieselbe maximale Breite von 1·62 mm. und sieht glänzendschwarz, wie poliert aus. Man kann auch hier Feinhaare und haarähnliche " Borsten " unterscheiden. Bei *wasmanni* gibt es Feinhaare nur längs eines schmalen Streifens am Seitenrande, der an der Basis beginnt und etwa am Ende des zweiten Drittels des Seitenrandes endet. Die " Borsten " meiden einen schmalen Streifen längs der Mediane und sind sonst gleichmässig verteilt, im ganzen jederseits etwa 60, bei denen man etwa 10 nicht sehr regelmässige Querreihen unterscheiden kann. Das Haar- und Borstenkleid der neuen Art scheint annähernd dasselbe zu sein wie bei *wasmanni*.

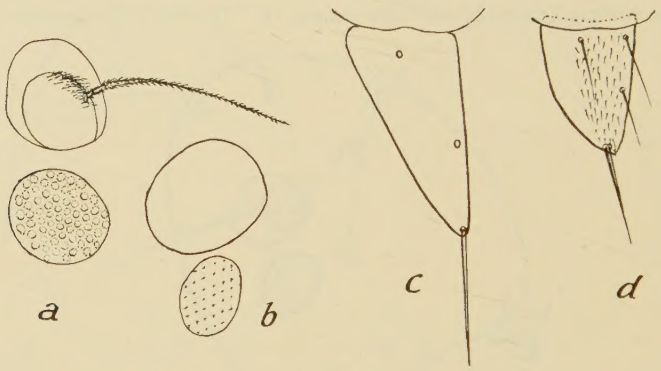

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Fig. 6.—a, b. Fühlergrube und Auge; c, d. Flügelrudiment; a, d. *T. wasmanni* Breddin & Börner; b, c. *T. burtti* sp. n.

Was die Form und Beborstung der Beine betrifft, so stimmt die neue Art auffallend mit *wasmanni* überein. Femur I hat bei beiden Arten nahe der Spitze ein schwach gekrümmtes Börstchen, das dorsal eingepflanzt, aber etwas posterodorsal orientiert und ein wenig schwächer ist als die Tibialbörstchen. Tibia I bei beiden Arten mit zwei Einzelborsten nämlich einer oberhalb und einer unterhalb der Mitte, beide dorsal eingepflanzt, aber, mehr oder weniger posterodorsal orientiert; ferner mit zwei ungleich grossen dorsalen und 1–2 schwächeren posterioren Endspornen.

Femur II bei beiden Arten gegen Ende mit drei ungleichen Borsten, nämlich einer subapikalen anterioren, starken, die etwas abwärts gerichtet ist, und zwei dorsal eingepflanzten, von denen die eine subapikal, die andere fast ganz apikal ist. Die apikale ist schwächer als die Tibialborsten, und abwärts, dabei bisweilen etwas nach hinten orientiert. Die subapikale ist ungefähr so stark wie die anteriore und im gleichen Sinne wie diese gerichtet, also abwärts und nach der anterioren Seite hin. Tibia II ist bei der neuen Art an beiden Beinen leider abgebrochen, aber wegen der grossen sonstigen Übereinstimmung kann angenommen werden, dass sie gerade so wie bei *wasmanni* beschaffen ist. Bei

wasmanni hat die Tibia II eine anterodorsale Einzelborste ungefähr in der Mitte, und dazu drei dorsale, nämlich eine am Ende des ersten Fünftels, eine etwas unterhalb der Mitte und eine subapikale. An der Spitze gibt es drei dorsale und drei ventrale Endsporne; davon sind der mittlere ventrale und der mittlere dorsale am längsten. Ferner gibt es auf der distalen Hälfte dieser Tibie sechs quer gerichtete Kämme von goldgelben Härchen hinter einander.

Femur III hat bei beiden Arten nur zwei von den drei Borsten, die oben von Femur II beschrieben wurden. Es fehlt die fast apikale Dorsalborste. Tibia III hat bei beiden Arten zwei unvollständige Serien von Einzelborsten, nämlich eine anterodorsale und eine dorsale. Die anterodorsale Serie (bei *wasmanni* 4, bei der neuen Art 3 Borsten) befindet sich auf der proximalen Hälfte der Tibie und reicht bis etwas unterhalb der Mitte; die dorsale Serie (bei beiden Arten aus drei Borsten bestehend) reicht von oberhalb der Mitte bis zur Spitze. Zwischen diesen beiden Borstenserien verläuft dorsal eine fast komplete Längszeile von feinen schwarzen Härchen. Tibienende bei beiden Arten mit drei dorsalen und drei bis vier ventralen Endspornen, und einer posterioren Reihe von mehr oder weniger kurzen Stiften nebeneinander.

Typus in British Museum.

II.

Sehr wichtig ist Mr. Burtt's Entdeckung, dass das Männchen der neuen Art geflügelt war. Es ist ausserordentlich zu bedauern, dass es ihm entkommen ist; es wäre sehr interessant gewesen, das Männchen der aberrantesten aller Phoriden kennen zu lernen. Wir wissen aber jetzt wenigstens, dass bei der *Thaumatoxena* von Burtt das gepaarte Weibchen vom Männchen im Fluge fortgeführt wird. Dies war schon von mehreren anderen Phoriden mit flugunfähigen Weibchen, besonders aus der Subfamilie AENIGMATIINAE, deren Arten alle myrmekophil oder termitophil sind, bekannt. Von einer südafrikanischen Art, *Aenigmatistes blattiformis* Schm., wurde auch bereits eine Skizze eines solchen Pärchens veröffentlicht, (1933, *Natuurh. MaandB.*, **22** : 43).

Aber wir wissen noch viel mehr, oder können es wenigstens mit einer an Sicherheit grenzenden Wahrscheinlichkeit vermuten. Wir müssen vermuten, dass überhaupt alle *Thaumatoxena*-Arten geflügelte Männchen haben, und dass die ganze Literatur über *Thaumatoxena* gründlich revidiert werden muss, da es in dieser Gattung offenbar viel mehr Arten gibt, als man bisher dachte; alle bisher beschriebenen Exemplare sind Weibchen, und die immer als sexuell betrachteten Unterschiede sind Artunterschiede !

Die unglückliche Konfusion geht zurück auf Breddin und Börner 1904. Sie hatten von Wasmann fünf Exemplare eines rätselhaften afrikanischen Termitophilen zur Untersuchung bekommen, drei grössere (nicht von 2·4 mm., wie die Verfasser schreiben, sondern von 2 mm.) und zwei kleinere von 1 mm., die von Haviland in Natal bei *Bellicositermes natalensis* Haviland gefunden worden waren. In der Abhandlung " Über *Thaumatoxena wasmanni*, den Vertreter einer neuen Unterordnung der Rhynchoten " (1904, *SitzBer. Ges. naturf. Fr. Berlin* **1904** (5) : 84–93) beschrieben sie die Tiere, die sie für Hemipteren hielten, als *Thaumatoxena wasmanni*. Die drei grösseren sollten Weibchen, die zwei kleineren Männchen sein. Vom Männchen heisst es, das siebente Abdominalsegment sei wie beim ♀ einfach ringförmig, die folgenden Ringe seien zu einem komplizierten Gebilde verschmolzen, und zwar zu " äusseren Kopulationsorganen von unzweifelhaft männlicher Sexualität " (p. 90 Anm.).

Detailliertere Angaben wurden für später in Aussicht gestellt, sind aber niemals publiziert worden.

An einer von solchen Forschern und so bestimmt ausgesprochenen Behauptung bezüglich des Geschlechts zu zweifeln, schien bisher nicht erlaubt. Aber die Erfahrung Mr. Burtt's wiegt doch schwerer und zwingt dazu, bei Breddin und Börner einen Irrtum anzunehmen. Es entbehrt aller Wahrscheinlichkeit, dass bei zwei so nahe verwandten Arten wie *wasmanni* und der oben beschriebenen von Burtt die Männchen sich so grundverschieden verhalten sollten. Es ist als sicher anzunehmen, dass die Männchen aller Arten von *Thaumatoxena*, ähnlich wie die aller *Aenigmatistes*-Arten, geflügelt sind. Die angeblichen Männchen von *T. wasmanni*, die Breddin und Börner beschrieben haben, sind Weibchen einer von *wasmanni* verschiedenen Art. Von dieser Art haben wir ausser der summarischen Beschreibung ohne Abbildungen, die sich bei Breddin und Börner findet, eine reichlich illustrierte ausführliche Beschreibung von Trägårdh (an zwei Stellen: 1908, *Ark. Zool.* **4** (10), und 1909, *Zool. Jahrb.* (Syst.) **28**: 339–346). Deshalb wird im folgenden diese Art *Thaumatoxena trägårdhi* sp. n. genannt und das im Besitze von Trägårdh befindliche Exemplar zur Type bestimmt. Die Havilandschen Exemplare fehlen in Wasmanns Sammlung. Sie scheinen zuletzt bei Enderlein gewesen zu sein, der sie 1908, *Zool. Jahrb.* (Syst.) **27**: 154 erwähnt. Das Weibchen einer dritten Art wurde von Silvestri unter dem Namen *T. andreinii* beschrieben (1906, *Redia* **3**: 350–357, mit vielen Figuren), und zwar von Erythraea, als Gast von *Termes bellicosus* Smeathman. Trägårdh hält es für identisch mit seiner Art; aber *andreinii* ist durch Grösse, Färbung (ziegelrot) und Chätotaxie sicher davon verschieden. Dass die Type ein Weibchen sei, wird von Silvestri nicht angegeben, ist aber wegen der Beschreibung der dreigliedrigen Terminalia evident. Das Weibchen einer vierten Art wurde vor zwei Jahren von Poisson beschrieben, nach zwei von Grassé an der Elfenbeinküste bei *Trinervitermes trinervius* (Rambur) und *Bellicositermes natalensis* gefundenen Exemplaren; sie wird im folgenden *Thaumatoxena grasséi* sp. n. genannt. Poisson hält sie fälschlich für das ♂ von *wasmanni*. Die fünfte und letzte Art ist die oben beschriebene *Thaumatoxena* von Burtt.

Die bisher publizierten Beschreibungen und Abbildungen ermöglichen es, eine Bestimmungstabelle für die fünf Arten aufzustellen. Vorläufig muss darauf verzichtet werden, die Körperlänge von *Thaumatoxena trägårdhi* als Kennzeichen zu verwenden, weil bezüglich ihrer Unklarheit herrscht. In der Abhandlung von 1908 sagt Trägårdh p. 2, dass sein Exemplar ganz mit dem angeblichen ♂ von Breddin und Börner, dessen Länge von diesen Autoren auf 1 mm. angegeben wird, übereinstimme; aber p. 10 bildet er sein Exemplar in der Vergrösserung 43 ab; da die Figur 73 mm. lang ist, so wäre die wahre Körperlänge 1·7 mm. Möglicher Weise ist 43 ein Druckfehler statt 73; dann ergäbe sich als Körperlänge ebenfalls 1 mm.

Schlüssel der bisher bekannten *Thaumatoxena* ♀♀.

1. Körperlänge gegen 2 mm., sie verhält sich zur grössten Breite wie 7 : 6. Zweiter Abdominaltergit mit mehr als 100 abstehenden langen Haaren (abgeschwächten " Borsten "). Auge mit mehr als 30 Ommatidien. Tibia I mit zwei dorsalen Einzelborsten und ausserdem mit Endspornen 2.
–. Körperlänge unter 2 mm., sie verhält sich zur grössten Breite wie 7 : 5 oder 7 : 4½. Zweiter Abdominaltergit mit 20–50 abstehenden Haaren (" Borsten "). Auge mit nur 13–16 Ommatidien. Tibia I ohne dorsale Einzelborsten, mit oder ohne Endsporne . . . . . 3.

2. Auge deutlich, im Umriss rundlich, fast so gross wie die Fühlergrube, mit ± 60 Ommatidien. Längenverhältnis des ersten und zweiten Abdominaltergits 1 : 6. Flügelrudiment (am Vorderrand) 0·32 mm. lang . .
Thaumatoxena wasmanni Breddin et Börner, Natal.

–. Auge etwas undeutlich, im Umriss elliptisch, und zwar etwa 1½ mal länger als breit, viel kleiner als die Fühlergrube, mit etwa 35 Ommatidien. Längenverhältnis des ersten und zweiten Abdominaltergiten 1 : 12. Flügelvorderrand 1½ mal länger . . . . . .
Thaumatoxena burtti sp. n., Tanganyika Territory.

3. Abstehende Haare (" Borsten ") des Thorax und Abdomens relativ sehr lang, meist von ⅔ der Länge des zweiten Abdominaltergits. Verhältnis von Länge und Breite des ganzen Körpers etwa 7 : 5. . . . . .
Thaumatoxena trägårdhi sp. n. (= *T. wasmanni* Breddin et Börner sogenannte ♂). Zululand.

–. Abstehende Haare (" Borsten ") der Oberseite relativ viel kürzer, höchstens = ¼ der Länge des zweiten Abdominaltergits, meist weniger als ⅕ 4.

4. Körperumriss breitelliptisch, Längen–Breitenverhältnis 7 : 5. In der Länge verhalten sich Thorax, erster und zweiter Abdominaltergit wie 13 : 0 : 33 (der erste Abdominaltergit fehlt angeblich, falls er doch vorhanden ist, muss er wohl sehr kurz sein). Zweiter Abdominaltergit mit 20–30 abstehenden Haaren (" Borsten ") und mit Feinbehaarung auch an und vor dem Hinterrande. Femur I über dreimal länger als breit. Tibia II auf der distalen Hälfte mit anterodorsalen Querkämmen . . . . .
Thaumatoxena andreinii Silvestri, Eritrea.

–. Körperumriss länglicher, Längen–Breitenverhältnis 7 : 4½. In der Länge verhalten sich Thorax, erster und zweiter Abdominaltergit wie 11½ : 5 : 42. Zweiter Tergit mit etwa 50 abstehenden Haaren (" Borsten "), hinten ohne Feinbehaarung. Femur I nur etwas über 2 mal länger als breit. Tibia II ohne anterodorsale Querkämme . . . . . .
Thaumatoxena grasséi sp. n. (= *T. wasmanni* Poisson *nec* Breddin et Börner), Elfenbeinküste.

H. S.

HELIAESCHNA CYNTHIAE, A NEW SPECIES OF DRAGONFLY FROM UGANDA (ORDER: ODONATA)

By Lt.-Col. F. C. Fraser, I.M.S. Retd., F.R.E.S.

In 1928, *Trans. R. ent. Soc. Lond.* **76**: 136, I described a new species of dragonfly under the name *Gynacantha libyana*. Since then I have received more specimens and now find that the species should have been placed in *Heliaeschna*, a genus very closely allied to *Gynacantha* and only separated by the presence of cross nervures in the median space. Along with the additional specimens of *H. libyana*, is a single male, closely resembling *H. libyana* but considerably smaller and with entirely differently shaped anal appendages. I am able also to describe now the female of *H. libyana*, this sex being unknown at the time the original description was made.

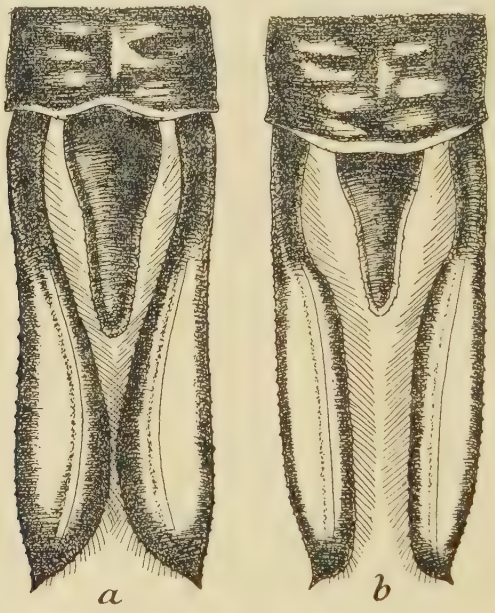

Fig. 1.—a. Anal appendages of *Heliaeschna cynthiae* sp. n., b. The same of *Heliaeschna libyana* (Fraser).

Heliaeschna libyana (Fraser).

Female. Abdomen 53 mm. Hind-wing 52 mm.

Exactly similar to the male in colouring. The oblique blackish-brown stripe on the sides of thorax is bordered anteriorly by a yellow stripe of equal thickness. (This stripe

is partially lost in the males under examination, probably from postmortem changes.) The legs are reddish throughout save for the proximal ends of tibiae and distal ends of femora, which are blackish. Wings similar to those of the male but the basal dark reddish-brown rays rather more extensive. Venational details: 10 cells in discoidal cells of fore-wings, 7–9 in the hind-wings; 2 rows of cells in fork of IRiii and 6–8 rows between it and Rspl; 5–6 median cross nervures; 9–10 cubital nervures; nodal index $\frac{24–33}{28–25}\,|\,\frac{34–26}{26–25}$; 9–11 hypertrigonal cross nervures; 1 complete and 1–3 incomplete basal antenodal nervures.

Anal appendages very narrow at bases (the ends have been fractured off, as so often happens during ovipositing in species of *Gynacantha* and *Heliaeschna*).

Habitat: Uganda: Entebbe, alt. 3800 ft. A single female (*Capt. C. Pitman*).

Heliaeschna cynthiae sp. n.

Male. Abdomen, including anal appendages, 52 mm. Hind-wing 45 mm.

Colour exactly similar to that of *H. libyana* save that there is no sign of the oblique stripes on the sides of thorax. The legs are entirely reddish, including the ends of femora and tibiae.

Wings very broad, reticulation more open than in *H. libyana*, very palely and evenly infumated throughout and with dark reddish-brown rays at the bases of all, exactly similar to those seen in *H. libyana*; membrane pale greyish; pterostigma covering 4–5 cells, shorter than in *H. libyana* but similar in colour; 7 cells in all discoidal triangles; 2 rows of cells in fork of IRiii and 5–6 between it and Rspl; 4–5 cross nervures in median space; 10–11 cubital cross nervures in fore-wings, 8–9 in the hind-wings; anal-loop with 14–15 cells; nodal index $\frac{22–31}{22–24}\,|\,\frac{28–20}{21–21}$; anal triangle 3 celled (*H. libyana* has 4 and not 3 as stated by me); 1 complete and 1 incomplete basal antenodal nervure in all wings.

Anal appendages 7 mm. in length and relatively longer for the size of the insect than in *H. libyana*, pale reddish-brown, narrow for the basal two-fifths, then expanding gradually on the inner side which is strongly convex; the apical fifth again contracting and tapering to a fine point. Inferior appendage half the length of superiors, tapering to an obtuse apex.

Habitat: Uganda: Entebbe, Lake Victoria. A single male (the type) (*Dr. G. D. Hale Carpenter*), 5.xi.27. This new species is named after Miss Cynthia Longfield. The type is in my collection.

The definitions given for the two genera *Gynacantha* and *Heliaeschna* have differed in only one respect, viz., that of the median space, which is traversed by one or more nervures in the latter, but always free of such nervures in the former. I now add a second and, perhaps, a more important character to distinguish them, viz., the presence of additional basal antenodal nervures in *Heliaeschna*. These are quite unknown in genus *Gynacantha* in so far as species of the Old World are concerned, but they are invariably present in two aberrant New World species, *G. membranalis* Karsch and *G. gracilis* Burmeister; probably these two will need removing to a new genus.

Key to the African species of genus Heliaeschna.

1. { Conspicuous blackish-brown markings at the bases of all wings . . 2.
   { Basal markings of wings vestigial or absent . . . . . 4.

2. Superior anal appendages razor-shaped, 2·5 times as long as inferior appendage; 4 cells in the anal triangle; 9–10 cells in the discoidal triangles of fore-wings . . . . . *libyana* (Fras.).
   Superior anal appendages lanceolate, length variable; 3 cells in the anal triangle; 7–8 cells in the discoidal triangles of fore-wings . . . 3.

3. Superior anal appendages 3 times as long as the inferior (2·7 to 1·0); length of hind-wing 54 mm.; femora reddish, distal ends of femora and whole of tibiae and tarsi black . . . . . *lanceolata* Le Roi.
   Superior anal appendages only twice the length of inferior; length of hind-wing 45 mm.; legs entirely reddish . . . . *cynthiae* sp. n.

4. Wings hyaline, uncoloured; pterostigma 3 mm. in length, black; only 5 cells in discoidal triangles; length of hind-wing 42 mm. *ugandica* McLachlan.
   Wings uniformly tinted with fuliginous; pterostigma very long, brown; 8 cells in the discoidal triangles; length of hind-wing 48–51 mm. *fuliginosa* Selys.

Book Notice.

Étude biologique de la race rurale de Culex pipiens *L.* By P. Lacour. pp. 125, 16 figs. 8vo. Clermont-Ferrand. 1937.

This book is an account of breeding experiments carried out by the author on a race of *Culex pipiens*. It comprises nine chapters as follows :—

Conditions of breeding for anautogenous *C. pipiens*.
An examination of some morphological characters.
The life of the " moustique rural " in nature.
A biological study of the larva.
Absence of autogenism in the " moustique rural."
Eurygamy and egg-laying.
The absence of cyclical fatigue.
Hibernation.
General considerations of the life-cycle.

The book is completed by a bibliography and a chapter on conclusions.

Much of the work described in the book is original, and of it a large part was carried out under natural conditions and the remainder under strict laboratory conditions by the author.

The mosquito called " moustique rural " by Prof. Lacour is *Culex pipiens pipiens* Roubaud.

ADDITIONS TO THE FAMILY CORDULIIDAE INCLUDING DESCRIPTIONS OF TWO NEW SPECIES AND A NEW GENUS (ORDER—ODONATA)

By Lt.-Col. F. C. Fraser, I.M.S. Retd., F.R.E.S.

Mr. Kenneth Morton of Edinburgh has kindly delegated to me the task of describing a new Corduliine which he has had in his collection for a long time past. The specimen is labelled "French Guiana," but although there exists some doubt about the locality, there are also strong reasons to believe it to be correct as the specimen was received with other insects from French Guiana. The placing of this species has offered some difficulty, as although the venation is purely that of *Gomphomacromia*, the general facies differs from that of other species belonging to the genus and the anal appendages are rather typical of those found in *Macromia*. On account of these doubts, Mr. Morton has suggested the specific name of "*dubitalis*," which I have adopted.

I take this opportunity to deal with some other species belonging to the same family; these are as follows :—

1. A new *Idionyx* which I have had in my possession since 1933, but which I hesitated to describe because I did not possess the male. There seems little prospect of obtaining this now, and as species of the genus are usually founded on female characters, viz., from the shape of the vesicle, which, in this particular species, is highly specialised, I have now decided to name and describe it.

2. The undescribed female of *Somatochlora braueri* (Selys) from New Zealand. I also figure the male anal appendages which have not been shown before. Martin (1906, *Cat. Coll. Selys* **17** : 20) described them as having a slight swelling on the outer side, but it would be more correct to state that they are strongly elbowed and angulated inward near their middle, as shown in my figure. This species is the only one of the genus found in the southern hemisphere, most others being palaearctic, and as such, has always been regarded as an anomaly. I find that it possesses two striking characters which are unshared by any other species in the genus, and I regard these as sufficiently important to remove it to a new genus of its own, which I name *Antipodochlora*.

3. Additions to the descriptions of the superior anal appendages of *Paracordulia villosa* (Rambur) (fig. 1, *e* and *f*). No author dealing with this species appears to have noticed that, in addition to the subbasal spine, there is a second and much smaller ventral spine situated near the middle of the appendages. Martin (*op. cit.*) neither mentions it in his description nor shows it in his figure, which latter is so poor as to be unrecognisable; it is very distinct in my specimens and, concerning the type in the Vienna Museum, Professor Rebel has kindly informed me as follows: ". . . der basale (proximale) Dorn des Anhänges kurzer und etwas breiter als in ihrer Skizze ist. Auch der distale, kleine Dorn ist vorhanden aber sehr klein. In der Daraufsicht erscheint die innere Begrenzung der Anhänge nicht so gleichmässig gerundet, was aber durch eine andere Lage der Anhänge verursacht sein kann." I therefore give a fresh figure of these appendages.

4. The undescribed female of *Procordulia grayi* (Selys).

Systematic.

Gomphomacromia dubitalis sp. n. (fig. 1, *a* and *b*).

Head : labium, labrum, clypeus and frons dark reddish-brown, the latter with a very deep median fissure dividing the upper surface of face into two triangular facets, the middle

ocellus lying deeply sunk at the posterior part of the fissure. Eyes dark brown but probably emerald green during life; occiput small, dark brown. Prothorax and thorax dark olivaceous brown with a poorly marked metallic green reflection on dorsum and a more brilliant metallic bluish-green reflection on the sides. The latter marked with two narrow, oblique, citron-yellow stripes, one on the mesepimeron, the other on the posterior border of the metepimeron. Legs blackish or dark reddish-brown; all tibiae keeled.

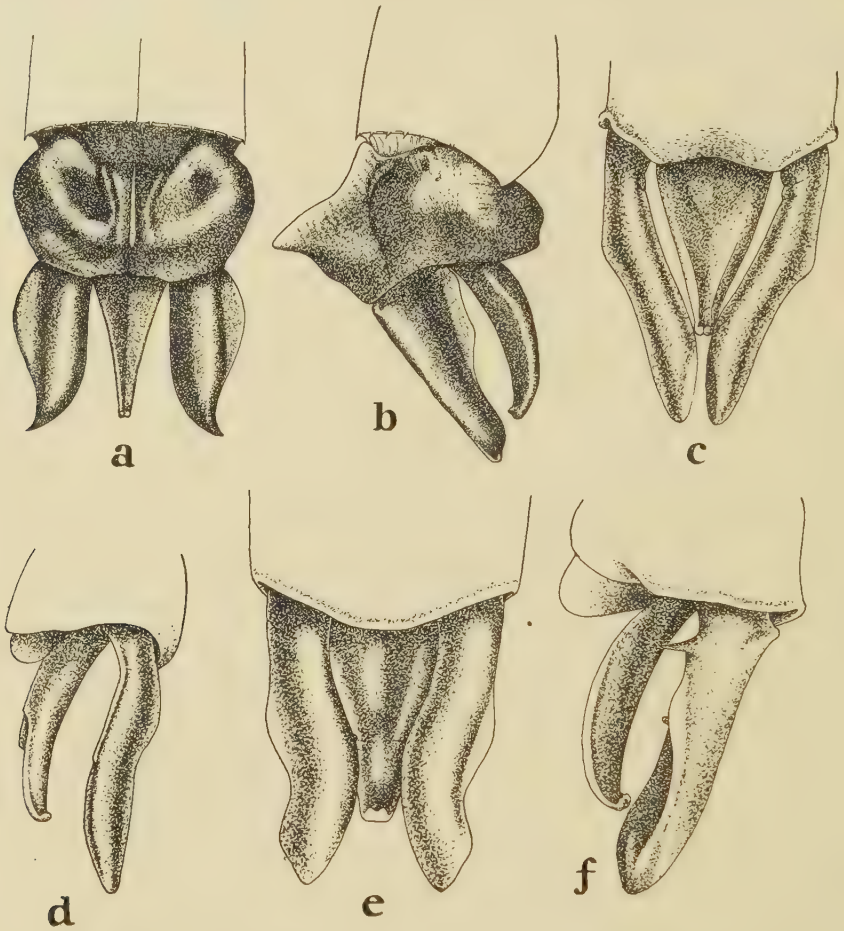

Fig. 1.—*a*. Dorsal view of segment 10 and anal appendages of *Gomphomacromia dubitalis* sp. n.; *b*. The same seen from the left side; *c*. Dorsal view of anal appendages of *Antipodochlora braueri* (Selys); *d*. The same seen from the left side; *e*. Dorsal view of anal appendages of *Paracordulia villosa* (Rambur); *f*. The same seen from the left side. (Camera lucida studies all drawn to the same scale.)

Wings slightly infuscated; venation rather open; nodal index— $\frac{5\text{–}11}{8\text{–}7} \Big| \frac{11\text{–}6}{7\text{–}9}$; subnodal space, distal to nodus, with 4 cross-nervures in fore-wings, 5 to 6 in the hind-wings; all triangles entire; discoidal triangle in hind-wing, with basal side slightly distal to the level of arculus; anal-loop abbreviated, 7-celled; a single row of post-trigonal cells in fore-wings for 10 to 11 cells, extending thus to level of nodus; only 3 post-trigonals in the hind-wings; discoidal field dilated slightly at termen, 3 to 4 cells wide at this level in fore-wings. Pterostigma short, 2 mm. in length, dark reddish-brown. Anal triangle 2-celled; sectors of

arculus meeting only at origins; 2 rows of postcubital cells in anal area of fore-wings; 2 rows of cells between anal-loop and posterior border of wing.

Abdomen blackish-brown marked with citron-yellow as follows: segment 2 with the oreillets, a pair of narrow postjugal spots and a spot at the apex of lobe; segments 3 to 7 with paired crescentic antejugal spots on dorsum, which become progressively smaller from segments 4 to 6 but enlarge again on segment 7, where they are almost confluent over dorsum of segment; remaining segments unmarked. Segment 8 with a small conical protuberance beneath, situated at its basal third, closely similar to, but smaller than, the protuberance found in *Neocordulia androgynis* Selys. Segment 10 with a very robust cone-like, mid-dorsal spine prolonged basally as a keel-like ridge, which is bordered each side by a deep depression. Anal appendages as long as segment 10, the superiors slightly the longer; these very short and robustly built, subcylindrical but with a lateral keel-like expansion on the outer side for the basal two-thirds; tapering to a point which is turned out rather abruptly. Seen in profile, they are very broad at base and then taper gradually to near the apex and very abruptly so at the point where the lateral expansion ends. Inferior appendage narrowly triangular, minutely emarginate at apex, which is curled upwards rather strongly.

Habitat: French Guiana. Under the old Selysian classification, this new species belongs to the large genus *Gomphomacromia*, which includes *Syncordulia*, *Oxygastra*, *Nesocordulia*, *Neocordulia* and *Gomphomacromia*. In its venation it resembles *Gomphomacromia*, but by the process beneath segment 8, similar to that of *N. androgynis*, it appears to be allied to the sister genus *Neocordulia*. A knowledge of the female genitalia is necessary to settle this point and for the time being one must abide by the venation and place it in *Gomphomacromia*. From the four known species belonging to this genus, viz., *G. paradoxa* Brauer, *G. fallax* McLachlan, *G. nodisticta* Ris, and *G. longipollex* Calvert, all from Central and South America, *G. dubitalis* is easily distinguished by the entirely different shape of its anal appendages, which, as has been stated above, are remarkably similar to those of *Macromia*. The type is in the Morton collection.

Whilst dealing with the two closely related genera *Neocordulia* and *Gomphomacromia*, it is well to point out a curious error in Martin's Monograph (*op. cit.*: 55 and 56). Here he has placed *Neocordulia volxemi* (Selys) in *Gomphomacromia*, giving as his reasons for this step, that the type has a single row of post-trigonal cells in the fore-wing, yet, if one refers to the figure of the wings of the type shown on p. 55, it will be seen that there are actually 2 rows of post-trigonals! This latter character, in conjunction with the short ovipositor of the species, places it without any doubt in the genus *Neocordulia*. Kirby has shown it correctly as a *Neocordulia* in his Catalogue.

Idionyx periyashola sp. n.

Female. Abdomen 38 mm. Hind-wing 34 mm.

Head: labium ochreous; labrum reddish-brown with two very large, diffusely limited citron-yellow spots at its centre; anteclypeus reddish-brown, postclypeus steely bluish-black; frons dark metallic green; vesicle steely blue-black, very large, steeply conical, its apex bifid; eyes emerald green; occiput black. Thorax metallic green with two narrow citron-yellow stripes on each side, one on the mesepimeron, the other on the posterior border of the metepimeron. Beneath yellowish with a clover-leaf-shaped spot blue-black metallic. Legs dark reddish-brown. Wings slightly infumated, with the areolets paler centrally; bases of all wings saffron-suffused to as far out as the second antenodal nervure; pterostigma black, covering two and a half cells; nodal index— $\frac{9\text{–}14}{8\text{–}9} \mid \frac{14\text{–}7}{9\text{–}9}$; anal-loop 11 celled. Membrane white, tipped with brownish at apex. Abdomen black, unmarked.

Habitat: Travancore: Western Ghat out from Manar, alt. *c.* 3500 ft., 17.v.33. This species is quite easily distinguished from all others of the genus by the highly specialised shape of its vesicle. Type in my own collection. The name is derived from the Tamil for " great forest " and refers to the vast expanse of primaeval jungle which was overlooked from the spot where I took this species.

Antipodochlora gen. n.

A genus with the characters of *Somatochlora* Selys but differing in the following points: frons very broad and flattened anteriorly, as broad or broader than thorax, fringed laterally with stiff, bristle-like hairs; arculus situated at the level of the second antenodal or but a shade proximal to it.

Genotype: *Epitheca braueri* Selys.

The shape of the head is closely similar to that of *Allogaster* and *Cephalaeschna* and quite unlike that of any other species of *Somatochlora*. In the latter genus, the arculus is situated midway between the first and second antenodals; recession of the arculus is a modern development, so that the distal position of this structure in *Antipodochlora* clearly demonstrates it as more archaic.

Antipodochlora braueri (Selys) (fig. 1, *c* and *d*).

Female. Abdomen 37–38 mm. Hind-wing 37–38 mm.

Head: labium ochreous, labrum reddish-brown, anteclypeus pale creamy-yellow, postclypeus and frons dark reddish-brown, the latter bronzed green above and with a large yellow spot on each side against the eyes (this spot present also in the male, although not mentioned in the Selysian description). Rest of head and thorax as in the male. Paler markings on abdomen more extensive than in the male and more extensive on the last three segments than on the preceding (these markings are probably rich ochreous in the living insect but they are largely obscured by decomposition in my specimens as well as in the type). Wings slightly infumated, this tending to form a network corresponding to the cellules of the wings; the infumation deepened to form a large oval patch in fore-wings extending from near the nodus to slightly distal of the pterostigma. Extreme base of hind-wings diffusely saffron-tinged. Nodal index higher than in the male— $\frac{9\text{–}8\text{–}10}{10\text{–}6} \mid \frac{10\text{–}8\text{–}10}{6\text{–}9}$; other venational details similar to the male.

Ovipositor half the length of segment 8, triangular, deeply cleft for its apical two-thirds, the apices of the lobes thus formed turned slightly outwards. Anal appendages as long as segment 9, cylindrical, tapering to an obtuse point.

Procordulia grayi (Selys).

Female: abdomen 34 mm. Hind-wing 34 mm.

Exactly similar to the male save for sexual characters. In both sexes there is a very broad fascia on each side of frons pale creamy-yellow, which has not been mentioned in the Selysian description.

Wings similar to the male but the infuscation deepened along the whole costal border of both fore- and hind-wings. Nodal index, in both sexes, very variable—7 to 9 antenodals and 6 to 9 postnodals in fore-wings, 5 to 6 antenodals and 7 to 9 postnodals in hind-wings.

Ovipositor represented by three small tubercles, nearly obsolete, its function apparently taken over by the overlapping pleura. Anal appendages very long, as long as the combined 9th and 10th segments, cylindrical with obtusely pointed apices.

I have to thank Mr. G. C. Hudson of New Zealand for a large number of both sexes of this species and of *A. braueri* (Selys).

ON THE RELATIONSHIP OF THE HYMENOPTEROUS GENUS *OLIXON* AND ITS ALLIES, TO THE POMPILIDAE (HYM.).

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Communicated by Dr. O. W. Richards, F.R.E.S.

Whilst engaged in a comparative study of the thorax of wingless Hymenoptera, I examined specimens of *Olixon testaceum* Cameron in the collection of the British Museum. The following day I was examining wingless Pompilids and looked at a specimen of *Apteropompilus dentatus* Cameron. I was astonished to find that it was extremely like *Olixon testaceum*; so much so that the two genera are obviously closely related.

The relationships of *Olixon* have always been a puzzle. Cameron, who originally described the single species *testaceum* in 1887 and erected the genus *Olixon* for it, placed it in the Braconidae, though admitting that he was uncertain what its true natural position was and regarding it as having points of similarity with the Bethylidae. Ashmead (1900) placed it in the Bethylidae, subfamily Emboleminae. Kieffer (1911) redescribed it and placed it without question in the Bethylidae under the name *Saphobethylus pallidus*. Turner and Waterston (1917), by comparison of the types, showed that *Saphobethylus pallidus* Kieff. was a synonym of *Olixon testaceum* Cameron and on the grounds of similarity of the male genitalia with those of *Rhopalosoma*, and because of the long antennae, suggested that it belonged to the Rhopalosomidae; the specimens in the British Museum collection were placed under that family.

However, a comparison of *O. testaceum* with *Apteropompilus dentatus* showed at once that *O. testaceum* is a Pompilid, provided that *A. dentatus* is correctly placed in the Pompilidae. Of this there seems to be no doubt, for though originally placed by Cameron (1904) in the genus *Apteropompilus* Brauns, 1898, it is now placed in the genus *Psyllosphex* Arnold, 1934, along with two other species described by Arnold. Though the species of *Psyllosphex* have the wings much reduced or absent, they seem to be true Pompilids and, moreover, have a number of points of resemblance with the genus *Homonotus* Dahlb. in which the species are normally winged.

Dr. O. W. Richards has examined the specimens and confirmed my opinion that *Olixon* is undoubtedly a Pompilid genus of the subfamily Homonotinae. I am deeply indebted to him for his help and advice and for putting me in touch with the literature on *Olixon*. I should also like to thank Mr. R. B. Benson for putting the facilities of the British Museum (Natural History) at my disposal.

Although *Olixon* is so clearly related to *Psyllosphex*, it is nevertheless generically distinct and thus there is no question of sinking a generic name. There follows below a list of the more important points of similarity and of difference between *Apteropompilus* [*Psyllosphex*] *dentatus* and *O. testaceum*. I hope that an examination of these and of the figures (which have been drawn using a binocular microscope and a squared eyepiece) will enable anyone who has not access to specimens of both genera to reach the same conclusions as to the affinities of *O. testaceum* as are expressed here.

It should be mentioned at this point that Brues (1922), in a paper on *Olixon* and allied genera, gives a key to separate the genera, in which he has evidently

used Cameron's description of *Olixon*, which is not wholly correct. Brues separates *Olixon* on the character of the second segment of the abdomen, stated to be only a little longer than the third; this is implied in Cameron's description, but in fact the second segment is twice or more times as long as the third (fig. 1, a). Cameron also states that the wings are without veins, which is incorrect.

Characters shared by *Olixon testaceum* Cameron and *Psyllosphex dentatus* (Cameron).

1. The shape of the head. In particular its outline in dorsal and in side view, and the concave occiput (fig. 2, c) which gives it a very characteristic appearance.

2. The maxillary palps. These are six segmented; the third segment bears an apical spine and the terminal three segments are considerably more slender than the first three (see Arnold, 1935).

3. The presence of a furrow (malar furrow) in each malar space connecting the ventral margin of the eye with the base of the mandible.

4. The shape of the thorax in dorsal view. In particular the posterior region of the propodeum which terminates on each side dorsally in an acute tooth. The posterior face of the propodeum is concave and nearly vertical.

5. The position of the propodeal spiracle, which in contrast to its position in winged Pompilids in the anterior third of the propodeum, occupies a secondary position in the posterior half or two-thirds of the propodeum.

6. The front femora. These are swollen, though much more strongly in *P. dentatus*.

7. The shape of the abdomen and the relative sizes of the segments. In particular the characteristic condition of the first segment, which is somewhat campanulate and is separated from the second by a deep crenulate groove above and below, the groove being somewhat overhung by the posterior margin of the first segment. In *P. dentatus* the groove is not crenulate ventrally.

8. The tarsal claws and pulvilli of the females. The former are bent at right angles near their tips and the pulvilli are large.

Characters in which *O. testaceum* and *P. dentatus* differ from one another.

1. The antennae. Those of *O. testaceum* are about as long as the body, and the segments of the flagellum are five or more times as long as wide. The antennae of *P. dentatus* are only about as long as the head and thorax and the segments are less than three times as long as wide. The pedicel of *P. dentatus* is more than half as long as the scape; that of *O. testaceum* is only one-third as long as the scape.

2. Viewed from above the head of *O. testaceum* ♀ is transverse and has a well-marked rim round the occipital margin. Neither ♂ nor ♀ has ocelli. The head of *P. dentatus* ♀ is quadrate; the posterior rim is much fainter and ocelli are present, though the ♂ lacks the median one.

3. Dorsally the eyes of *O. testaceum* approach closely to the occipital margin of the head; the eyes of *P. dentatus* are separated by about their width from the occipital margin.

4. The malar space of *O. testaceum* is longer than that of *P. dentatus* so that the length of the malar furrow is considerably greater than the basal width of the mandible, while in *P. dentatus* the malar furrow is shorter than the basal width of the mandible.

5. In the ♀ of *O. testaceum* the fourth segment of the hind tarsi, and to a

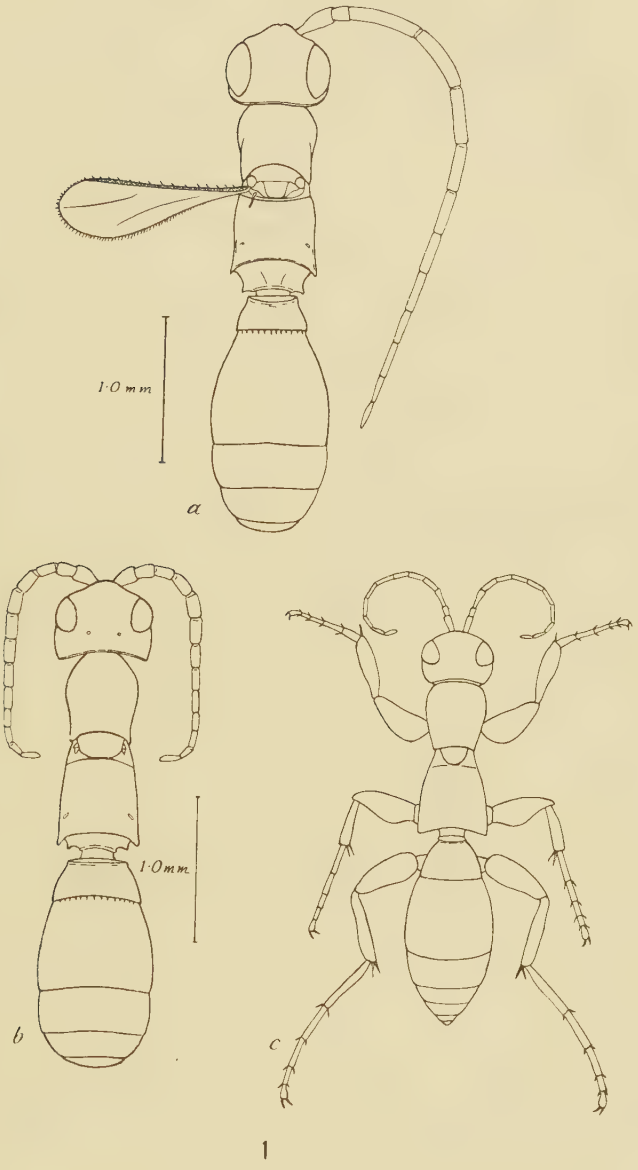

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FIG. 1.—a. *Olixon testaceum* ♂, dorsal view; b. *Psyllosphex dentatus* ♂, dorsal view; c. *Algoa heterodoxa* ♀ (after Brues).

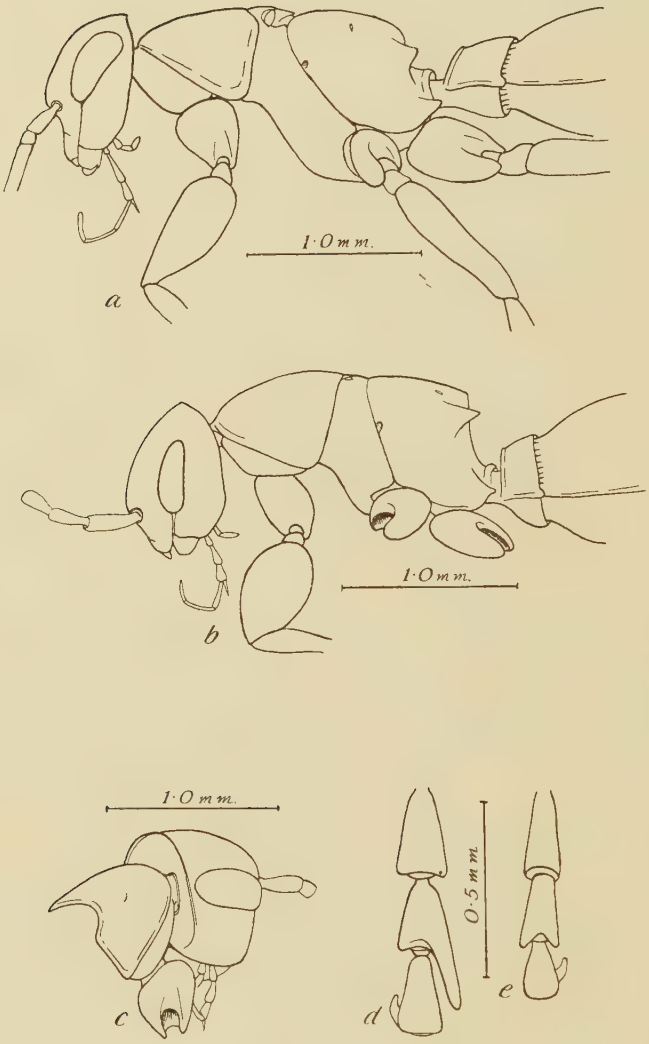

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Fig. 2.—a. *Olixon testaceum* ♀, head, thorax and first abdominal segment, lateral view; b. *Psyllosphex dentatus* ♀, same; c. *O. testaceum* ♀, head viewed from a postero-lateral angle to show the concave occiput; d. Terminal segments of the right hind tarsus of *O. testaceum* ♀. Bristles and hairs not shown; e. *P. dentatus* ♀, same.

lesser degree of the other tarsi, is very asymmetrically bilobed (fig. 2, d), the outer lobe being much larger than the inner one. This tarsal segment in the female of *P. dentatus*, though bilobed, is not asymmetrical.

6. Except for a blackish band towards the apex of the second abdominal segment, the eyes, the tips of the mandibles and the malar furrows, which are black, *O. testaceum*, as its name implies, is testaceous in colour. *P. dentatus* is dark brown to black. For a coloured figure of *O. testaceum* see Cameron (1887).

7. *P. dentatus* has the tegulae very reduced and the fore-wings reduced to minute scales (the hind-wings entirely absent). The scutellum is not distinguishable. *O. testaceum* has paddle-shaped fore-wings reaching beyond the apex of the first abdominal segment. The hind-wings are reduced to tiny thread-like strips. The scutum and scutellum are plainly visible. However, the condition of *P. dentatus* seems to be rather exceptional, for Arnold (1935) figures the thorax of *P. saltator* Arn. and *P. myrmosaeformis* Arn. which both possess fairly well-developed tegulae, while *P. saltator* has fore- and hind-wings apparently very similar to those of *O. testaceum*. The scutum and scutellum in both these species are similar to those of *O. testaceum*.

It is worth noting here that Arnold knew only Cameron's type specimen of *P. dentatus* which is a male, and he expresses the opinion that *Psyllosphex myrmosaeformis* Arn. may possibly be the female of *P. dentatus*. However, there is now in the British Museum collection a female apparently correctly identified as *P. dentatus*. This specimen was collected by R. E. Turner at Port St. John, Pondoland, S. Africa, in 1924. It has a mesonotum like that of the male type, in that the scutellum is missing or not defined, and the tegulae and wings are extremely reduced. The female of *P. myrmosaeformis* has a scutellum which Arnold describes and figures, and therefore *P. myrmosaeformis* and *P. dentatus* would appear to be distinct from one another.

Brues (1922) has expressed the opinion that the genera *Olixon*, *Harpagocryptus*, *Algoa*[1] and *Nealgoa* are closely related to one another. Examination of the descriptions he gives makes it almost certain that *Algoa* Brues, 1910 and *Nealgoa* Brues, 1922 are also Pompilid genera closely related to *Olixon*.

The affinities of *Harpagocryptus* Perkins, 1908 form a most intriguing puzzle. On looking up the reference given by Brues one finds that the paper he refers to was by R. C. L. Perkins, not J. C. Bridwell as he states, and that Perkins and not Bridwell founded the genus and described the single species *H. australiae*. The insect was reared from an Australian cricket of the family Trigonidiidae on which the larva had formed a sac like that made by some Dryinids upon Homoptera. This larval habit makes it extremely unlikely that *H. australiae* can be a Pompilid, since, so far as their habits are known, the Pompilids are exclusively hunters of spiders or occasionally parasitic upon other Pompilids. On the other hand, Perkins states that " it is clearly allied to the Central-American *Olixon* of Cameron " and his description fits that of *Olixon* remarkably closely. I quote his generic diagnosis of *Harpagocryptus* in full so that the characters may be compared with those of *Olixon*.

Harpagocryptus.

Perkins, R. C. L., 1908, *Proc. Hawaii. ent. Soc.* **2** : 27–35.

Head transverse in dorsal aspect, produced in the middle in front, large, wider than the thorax; the occiput arcuately emarginate; ocelli very feebly developed, the anterior one

[1] Kieffer (1914) in " *Das Tierreich* **41** " replaced *Algoa*, which is preoccupied, by *Algoella*.

almost or entirely aborted. Antennae 12 jointed, elongate, filiform, all the joints long excepting the small pedicel. Mandibles pointed at the tips to form a large acute tooth, internal to which are three very minute teeth on the edge. Maxillary palpi long, six jointed, the first joint short and stoutish, the second joint very elongate, twice as long as the first, slender at the base, clavate; third shorter than second, moderately stout, sub-parallel sided; fourth, fifth and sixth, slender, elongate, sub-equal. Labrum distinct, clypeus well defined. Prothorax large and long, narrowed posteriorly, and there emarginate; mesothorax very small, tongue shaped; tegulae distinct, front wings narrow, strap like, reaching to the posterior face of the propodeum, hind-wings wanting. Propodeum very long, its superior posterior angles produced into a strong acute tooth on each side. Front femora very stout, intermediate less strongly so; claws short, stout; pulvilli large, tarsi densely pubescent beneath. Abdomen elongate ovate, second segment much the longest.

This description only differs definitely from the characters of *Olixon* in three respects, and with those exceptions it may be taken as a supplementary description for *Olixon*. The presence of ocelli, the fore-wings strap-shaped rather than paddle-shaped, and the lack of hind-wings are the three exceptions; and in addition the colour of *H. australiae* is dark. An examination of such critical points as whether or no the third segment of the maxillary palps bears a spine at its apex, whether the first abdominal segment is separated from the second by a crenulate groove, whether the tarsal claws are bent at right angles near their tips, and whether the fourth tarsal segments are asymmetrical, should decide whether *Harpagocryptus* is really allied to *Olixon* and is therefore a Pompilid. If it should prove to be related to *Olixon* we shall have either to revise our ideas of the habits and affinities of the POMPILIDAE or to suppose that there has been some mistake made in recording *H. australiae* as a parasite of crickets.

Fig. 1, c of the ♀ of *Algoa heterodoxa* Brues is from the figure by Brues (1910). Comparison of the following characters of *Algoa heterodoxa* with the table of differences between *P. dentatus* and *O. testaceum* given earlier shows that *Algoa* is much more like *Psyllosphex* than like *Olixon*.

Some characters of *Algoa heterodoxa* Brues.

1. Head quadrate, not broader than long, concave posteriorly.
2. Antennae short, the segments barely three times as long as wide.
3. Maxillary palpi six segmented, the third segment with a spine at its apex.
4. Malar space with a furrow which is shorter than the basal width of the mandible.
5. Eye separated by its own width from the hind margin of the head. The cheeks and temples margined behind.
6. Wings absent, tegulae obsolete.
7. Front femora greatly thickened.
8. Propodeum with the hind margin arcuately excised, the hind angles produced and the posterior surface concave.
9. Ocelli obsolete.
10. Second abdominal segment much the longest and distinctly constricted at the base above and below.
11. Colour piceous.

Except for the obsolescence of the ocelli and the hind angles of the propodeum being produced, rather than strongly dentate, these characters are the same as those of *Psyllosphex*.

A similar table shows that *Nealgoa* is more nearly related to *Olixon* than to *Psyllosphex*.

Some characters of *Nealgoa* Brues, 1922.

1. Head from above as long as broad, produced medially in front, truncate behind.
2. Antennae longer than the head and thorax, segments long and slender.
3. Malar space much longer than the basal width of the mandible, but having no furrow.
4. Eyes approaching close to the occipital margin.
5. Pronotum almost as wide as the head.
6. Fore-wings like those of *O. testaceum*, paddle-shaped with a strong costa, which, however, extends to the tip of the wing; and two other weak veins. Hind-wings absent.
7. Propodeum with teeth at the postero-dorsal angles, posterior face concave and almost vertical.
8. First segment of the abdomen more or less campanulate, separated from the second above and below by a strong constriction.
9. Fourth tarsal segments thickened and emarginate at apex.
10. Ocelli obsolete.
11. *N. banksii* Brues, the only species, is non-punctate and fulvo-ferrugineous in colour.

Characters 2, 3, 4, 6, 10 and 11 are those which indicate affinity with *Olixon* rather than *Psyllosphex*, while 1 and 5 are more like the condition of *Psyllosphex*; 7 and 8 are characters common to *Olixon* and *Psyllosphex*, while the lack of a furrow in the malar area is a difference from both.

A further consideration, which lends strong support to the contention that *Algoa* is close to *Psyllosphex* and *Nealgoa* to *Olixon*, is that of geographical distribution. The genus *Psyllosphex* is South African, and the 4 female specimens, on which the genus *Algoa* was founded by Brues, were collected by Dr. Brauns at Algoa Bay, S.E. Africa. *Olixon testaceum* is recorded from Panama and Mexico amongst other localities; *Nealgoa banksii* Brues comes from Long Island, New York. In this connection there is a further interesting point: in the British Museum collection there is one very dirty specimen (female) of an unnamed species of Pompilid from Cairns, Australia. This insect appears to be somewhat intermediate between *Psyllosphex* and *Olixon*, for it has the asymmetrical fourth segment to the hind tarsi which is an important character of the ♀ of *O. testaceum*, and the fore-wings are closely similar. On the other hand, the segments of the antennae are short, and the antennae, now broken, were evidently about equal in length to those of *P. dentatus* (the short antennae show that it cannot be a *Harpagocryptus*); the insect is black.

The reader may have remarked the fact that Cameron made the original descriptions of *Olixon testaceum* and *Apteropompilus dentatus*; but in justice to him one must remember that he described *O. testaceum* 16 years before *A. dentatus*. Brues (1910), in his original description of *Algoa heterodoxa*, noticed that it bore a resemblance to a Homonotine Pompilid, but allied it with the Sclerogibbidae. In his later paper Brues (1922), as may be seen, allies *Algoa* with *Olixon*, but does not attempt to settle the affinities of *Olixon*, beyond stating that he does not agree with the views of Turner and Waterston who placed it in the Rhopalosomidae. These authors based their opinion on

a similarity in the male genitalia of *Olixon* and *Rhopalosoma* and on the fact that the antennae of *Olixon* are long. But since the antennal segments of the latter lack the spines which are characteristic of those of the former, this character does not seem to be important. Dr. Richards is of the opinion that in making out the relationships between families of Hymenoptera, the male genitalia are somewhat difficult to use and sometimes of dubious value. On the whole it seems unlikely that *Olixon* has any real affinity with the Rhopalosomidae, and if this is so it is not a connecting link between the Pompilidae and Rhopalosomidae.

Summary.

By comparison of the types of *Olixon testaceum* Cameron (= *Saphobethylus pallidus* Kieffer) and *Psyllosphex dentatus* (Cameron) it is shown that the two genera are closely related, and since *P. dentatus* is a Pompilid, *O. testaceum* therefore also belongs to the Pompilidae. Though the genera *Psyllosphex* and *Olixon*, as represented by *O. testaceum* and *P. dentatus*, are closely related they are generically distinct. By examination of the descriptions, it seems almost certain that *Algoa* and *Nealgoa*, considered by Brues to be related to *Olixon*, are also Pompilids; *Algoa* being closely related to *Psyllosphex* and *Nealgoa* to *Olixon*. The position of *Harpagocryptus* remains uncertain, for although the description is closely similar to that of *Olixon*, the recorded habit of the insect as a semi-endoparasite of crickets, makes it difficult to believe that it can be a Pompilid.

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